PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

High Efficiency Engines and Turbines

12/2002

THERMAL BARRIER COATINGS AND METALLIC COATINGS WITH IMPROVED DURABILITY

Description

PRIMARY PARTNER

University of Connecticut

TOTAL ESTIMATED COST

$ 319,918

CUSTOMER SERVICE

800-553-7681

STRATEGIC CENTER FOR NATURAL GAS WEBSITE

www.netl.doe.gov/scng

Under the Advanced Gas Turbine Systems Research (AGTSR) program, the University of Connecticut, and the University of Pittsburgh on subcontract, are evaluating approaches to improve the durability and reliability of coatings used to protect high temperature surfaces in turbines. Task 1 heat treats metallic coatings at various temperatures and oxygen partial pressures, characterizes resulting coating properties, and identifies the heat treatment and other processing variables that produce the most desirable properties. Task 2 conducts isothermal and cyclic oxidation tests of the metallic coatings produced using the heat treatment processes identified in Task 1. Task 3 involves selection of heat treatment variables for bond coated TBCs and evaluation of TBC spallation life during thermal cycling. The testing and analysis of resulting coating lifetimes will identify the processing approaches that produce the most durable and reliable coatings. Task 4 communicates the findings and understanding resulting from the project to the gas turbine industry.

One result of the project has been that polishing of the bond coat before applying the TBC can increase coating lifetimes by a factor of four (Figure 1).

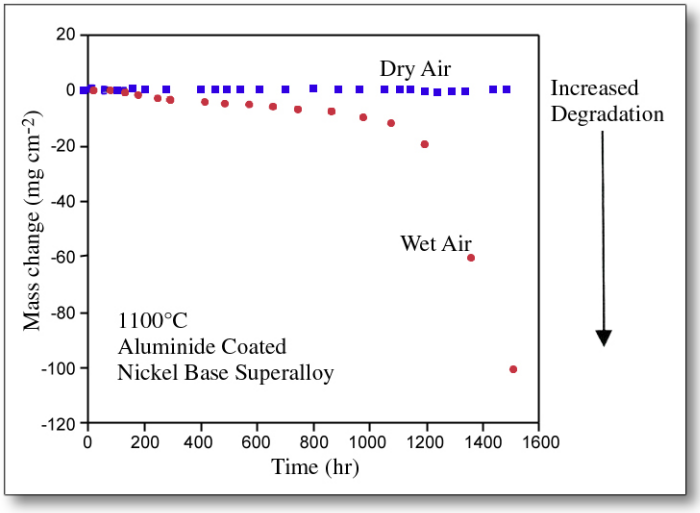

Figure 1. Polishing to remove ridges increases TBC lifetimes.

Thermal Barrier Coatings and Metallic Coatings with Improved Durability

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Duration

24 months

Goals

This project systematically varies metallic and TBC bond coat composition and processing features so as to obtain at least a factor of three improvement in durability compared to current TBC and metallic coatings.

Benefits

Thermal barrier coatings (TBCs) insulate turbine metal surfaces to reduce cooling requirements and thereby improve engine power and efficiency. Metallic coatings protect turbine surfaces from oxidation and corrosion. However, use of TBCs and metallic coatings in utility and industrial gas turbines with long life requirements has been impeded because of their lack of the necessary service durability and reliability.

This project is developing approaches to improve lifetimes of coatings.